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Short Communication

The effect of pesticides on fish fauna of Bhopal lower lake (M. P.)

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Studies on the toxicity of common pesticides and some industrial pollutants on fishes have been reviewed. Pollutants such as pesticides cause diseases, behavioral abnormalities, cancer and gene mutations in fishes. Physiological malformation, histological, hematological and biochemical changes have also been observed in fishes. Pesticides significantly affect the early life stages of fishes. Toxic effects of pesticides vary in different organs of the fish. Liver, gill, kidney are tissues that can accumulate high level of pollutants as well as other factors, such as salinity temperature, hardness, etc.

Key words: Bhopal lower lake, fishes, pesticides, toxicity.

INTRODUCTION

Industrial waste has long been recognized as serious pollutant of the aquatic environment. Pesticides have toxic effect on exposed organism. The presence of pesticides beyond permissible limits in water has been reported worldwide. Our study focuses on the toxic effect of pesticides on fish.

In lake, steps have been taken for the monitoring of pesticides and other pollutants level in water sample. Monitoring of pollutants has been done in the lake. Water samples collected from various sources in different sites of lake were analyzed and pesticides were found within the permissible level. Pesticides concentration in submerged plants and fish at various sites of Lower lake were observed only downstream sites and fish collected at Lake Weir, Lake dam, Lake hills, regions, which was possible due to discharge of pesticides containing influent from various industries along sites of the lake.

Most of the sites of lake are seriously polluted by industrial effluents. Effluents are waste products in liquid form resulting from industrial processing. They are released by different industries such as petrochemical complex, fertilizer factories, oil refineries, pulp paper, textile mills, sugar mills, steel mills and tanneries, etc. All the chemicals of industrial waste are toxic to animal and many cases of death or sub-lethal pathology of liver, kidney, gonads, nervous tissues of fishes have been reported.

By discharge from the effluent inflows, amount of pesticides in water show an increase. They are present in water in dissolved condition form only at low levels, since pesticide compounds have low solubility. Mineral suspension and precipitation substances are able to store pesticides ions on their outer surface. Pesticides can also be found in water organisms. They can be taken up by higher organism through the food chain and sink to bottom as sediment.

Pesticides are pollutants which affect the aquatic fish. Presence of pesticides show alteration of behavior, bio-accumulation of pesticides in the body of fish histopathological and biochemical alterations in fish. Pesticides also affect early life stages of fish (Table 1).

MATERIALS AND METHODS

Water samples were collected seasonally during June 2011 to July

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Table 1. Toxicity of pesticides on fishes.

S/N	Fish fauna	Effect of pesticides	Affected organism
1	*Catla catla*	Endosulfan carbonyl	Significant histological alteration in gill.
2	*Labeo rohita*	Chlorophyrifos	Biochemical changes of total protein and glycogen observed.
3	*Puntius punctatus*	Endosulfan and Diazinon	Affect of arginine and tryptophane showing the interaction of pesticides with cellular proteins depletion.
4	*Puntius punctatus*	Endosulfan and Diazinon	Alteration of calcium content in the stomach after pesticides treatment.
5	*Puntius punctatus*	Rogon (dimithoate)	Abnormal behavior pattern in fish
6	*Cyprinus carpio*	Carbofuran 16ppm	Decrease in total erythrocyte count, total leucocytes count and hemoglobin count.
7	*Cyprinus carpio and Puntius ticto*	Aldrin, Dieldrin BHC and DDT	Bioaccumulation of chlorinated pesticides in fish tissue gill, liver muscle and kidney observed.
8	*Mystus vittatus*	Dimecron and Thiodon	Rate of food intake, absorption and metabolism decrease from the control value
9	*Heteropneustes fossilis*	Endosulfan 0.00075 ppm 0.00050 ppm 0.000375 ppm	Increased concentration, of toxicant showed the decrease in liver glycogen. Hepatic cells are damaged due to depletion of glycogen.
10	*Heteropneustes fossilis*	Dimecron	Significant decrease in Hb%, RBC numbe and O2 carrying capacity of blood.
11	*Clarias batrachus*	Carbaryl and Phorate	Cholesterol level in serum decreased during exposure period
12	*Clarias batrachus*	Phorate 0.27ppm	Physiological and histological disorder in testis and ovary of insecticide exposed fish.
13	*Gambusia affinis*	Dimecron 0.0068ppm	Histopathological changes such as hepatic lesion with necrosis pyconic nuclei vasculation damaged blood vessel in alimentary canal, liver, kidney and gill.
14	*Oreochromus mossambica*	Endosulfan	Endosulfan induced dysfuncation of osmoregulation processes, resulting in alteration of ionic composition of blood.
15	*Nandus nandus*	Endosulfan and Diazinon	Significant histological alteration in gill and fin region.

2012 from polluted and non polluted selected sites using rottener water sampler and were estimated by standard methods as given by APHA (1985). Fishes were collected, arranged, preserved, identify and classify based on the work of Jhingran (1982), with slight modification by Day (1989) and Jayaram (1999).

RESULTS AND DISCUSSION

All pest destruction agents are collectively known as pesticides. The most frequent used pesticides are insecticides, herbicides and fungicides. Pesticides are of two type, naturally occurring and synthetic pesticide. Synthetic pesticides include chlorinate organophosphate and carbonate. Organophosphate is most toxic to vertebrate. Organophosphates inhibit cholinesterase an enzyme essential for transmission of nerve impulse across the synapse. Dichlorodiphenyltrichloroethane (DDT) and other organic chlorine chemical may have an influence on endocrinal system. DDT is highly stable chlorinated hydrocation or extremely low degradability. DDT is one of the most known pesticides previously used worldwide. The fat solubility and extreme persistence of DDT have led it to be stored in the body of almost all organisms. The use of DDT has been declared illegal by almost all countries. Pesticides also caused toxic effect on fish. Behavioral abnormalities include cancer, hematological and biochemical change which have been observed in pesticides exposed fish.

Abnormal behavior of *Puntius punctatus* due to exposure of Rogor insecticide have been previously reported. Bioaccumulation of Aldrin, Dieldrin, benzene hexachloride (BHC), and DDT in gill, liver, muscle and kidney of *Cyprinus carpio* and *Puntius ticto* was observed with alter the enzyme activity. Effect of pesticide was observed in the acetyl cholinesterase activity in the brain of *C. carpio* (finger lings).

Histology of gill was altered due to the effect of pesticide (endosulfan carbarly). Pesticides exposed fish also shows hematological changes. Decrease of erythrocyte and leucocytes count was observed in pesticide (car-

bofuran) exposed *C. carpio*. Dimecron exposed *Heteropneustes fossilis* showed significant decrease in Hb%, red blood cell (RBC) number and O_2 carrying capacity of blood.

In *Catla catla, Nandus nandus* and *Labeo rohita* significant histological and biochemical alteration in gill and fin region were observed due to the effect of endosulfan, diazinon and chlorophyrifos. Carbaryle and phorate, decreased cholesterol level in serum of *Clarias batrachus.* Endosulfan exposed *Oreochromus mossambica* showed dysfunction of osmoreguration processes, resulting in alteration of ionic composition of blood (Table 1).

Conclusion

Pesticides have been recognized as serious pollutants of aquatic environment. They affect fish directly by accumulation in their body. They cause serious impairment in metabolic, physiological and structural changes in different organs (Table 1). It may affect fish indirectly by transfer to the next tropic level of food chain. The accumulation of pesticides in the tissues of fishes can result in chronic illness and cause potential damage of population. Fish are able to accumulate and retain pesticides and other pollutants from their environment. Accumulation of pesticides in the tissue of fish is dependent upon exposure concentration as well as other factors such as salinity, temperature, hardness and metabolism of fish.

Pesticides affect specific vital organs such as liver, gill and kidney. Liver contains the highest pesticides concentration because it is an organ of storage and detoxification of pesticides. Liver plays an important role in detoxification and also act as an active site of pathological effects, induced by contaminants. Different degrees of pesticides accumulate in various tissues of gill and kidney. Fish may accumulate pesticides by absorption through gills. It has been observed that the concentration of pesticides in gill reflect the concentration of pesticides in water in which fish species live.

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